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Preliminary Water Control Plan for the Ten Mile Creek Deep Water Storage Area (DWSA)

This plan describes the proposed operating criteria for the four permanent structures: the Main Pump Station, S-382, for pumping water from Ten Mile Creek into the DWSA; the emergency spillway, located near the main pump station, intended to relieve the DWSA in the event of severe storms; Control Structure S-383, will deliver water into the treatment cell by the use of gravity flow or via two small pumps; and, culvert S-384 for the treatment cell outfall. All elevations in the Water Control Plan are referenced from the 1929 National Geodetic Vertical Datum unless otherwise stated.

Location. The Ten Mile Creek (TMC) project is located in St. Lucie County, southwest of Ft. Pierce. It is situated just south of State Road 70 (Okeechobee Road) and west of the intersection of I-95 and the Florida Turnpike and north of Midway Road. The project is located at the outlet of the 30,682 acre (48 square mile) Ten Mile Creek Basin.

General Objectives. The Preliminary Water Control Plan focuses on how the project will operate during the operational testing and monitoring phase of the project. This plan includes the flexibility to make incremental changes to the proposed optimum canal elevations, DWSA, and treatment cells throughout the testing period in order to achieve desired project benefits while maintaining the existing level of flood protection in the Ten Mile Creek Basin.

The Ten Mile Creek DWSA is ranked as the 11th most important of 34 Critical Projects. The Ten-Mile Creek Reservoir/Stormwater Treatment Area (referred to from this point on as the treatment cell) restores two degraded features of the North Fork Basin: basin storage and nutrient demand. Restoring these features gives a more natural pattern of freshwater flows into the estuary, more natural (lower) volumes of runoff leaving the basin and reduced nutrient loads leaving the basin.

The most important feature is the addition of water storage to the basin. Rapid pumping to the reservoir and slow drainage from the reservoir mimics the behavior of shallow surface storage that has been lost through development over the years. When operated correctly, the reservoir reduces runoff from most storm events and helps restore the historic flow pattern of freshwater entering the estuary. Water stored in the reservoir will also reduce total runoff leaving the basin and simultaneously reduce demands on the Floridan aquifer.

Another important feature is the ability of the reservoir and the adjoining treatment marsh to filter runoff, removing suspended sediments, phosphorous and nitrogen from runoff waters and improving downstream water quality.

Operations of the DWSA facilities should maximize pre-storm available storage, maximize dry-season water supply and maximize treatment of basin runoff. These are competing objectives that are balanced through the operating rules. Achieving an optimal balance will require adjustments in the operating rules to incorporate improvements in the understanding of watershed hydrology, local water management, and regional water management.

Current hydrologic analyses indicate the optimal balance occurs when pumps try to capture one-half of storm runoff (not baseflow) and when dry-season releases to the filter marsh decrease with decreasing storage. The following Preliminary Water Control Plan describes how this can be done.

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Features. This project consists of a DWSA storage area and adjacent treatment cell. The DWSA will have approximately 526 acres of effective storage area and the treatment cell will have roughly 132 acres of treatment area. Water will be put into the DWSA system via a 380 cfs pump station, S-382, located on the northern levee adjacent to the creek.

S-382, 380 cfs pump station will consist of three pumps; one 60 cfs and two 160 cfs pumping capacity. In addition, the pump station will have a return bay with a 200 cfs capacity for flows from the DWSA back to the creek. The DWSA and treatment cell will have a total storage capacity of approximately 6,000 acre-feet. An overflow weir set at elevation 29.00 ft-NGVD will also be included on the north side of the project adjacent to the creek for emergency flows.

The outflow structure, S-383, for the DWSA will consist of a 40 cfs control structure that will pass water by gravity from the DWSA to the treatment cell. Also, included are two small pumps with a 15 cfs and 25 cfs capacity. When the DWSA drops below the bottom elevation of the treatment cell (17.0 ft-NGVD), the gravity control structure will not be able to transfer flows and the pump can be used.

The outflow structure, S-384, for the treatment cell will consist of a 100 cfs gravity control structure that will flow into the North St. Lucie River Water Control District's (NSLRWCD) Canal 96. From this point, the water will flow north in Canal 96 and discharge downstream of the existing "Gordy Road" control structure on the eastern end of Ten Mile Creek. This control structure is owned and operated by the NSLRWCD.

The Gordy Road Control Structure, known as S-71-1 by NSLRWCD is a 4-bay radial gate spillway operated by NSLRWCD. The outside gates are two 18-foot wide radial gates, with a crest elevation of 9.3 ft-NGD and inverts of the gates are at elevation 3.0 ft-NGVD. The inside gates are two 18-foot wide radial gates, with a crest elevation of 10.0 ft-NGVD and inverts of the gates are also at elevation 3.0 ft-NGVD. The Gordy Road Control Structure is the easternmost water control structure. This structure is generally operated to maintain an upstream pool elevation of 9.5 ft-NGVD to 10.5 ft-NGVD. Additional operating details for this structure and other pertinent structures operated by NSLRWCD can be found by contacting the NSLRWCD office at (772)-461-5050.

NSLRWCD operates and maintains a complex system of interconnected canals, approximately 25 major water control structures, three drainage pump stations and three irrigation backpump stations that serve the District. The primary outfall routes of the western area of the NSLRWCD

are Ten Mile Creek; Five Mile Creek; Pump Stations 1, 2 and 3, as referred to by NSLRWCD; and gravity gated culverts at canals 33, 40, 41, and 53.

Constraints.

a. Must maintain current level of flood protection in the Ten Mile Creek drainage basin. Ten Mile Creek project should in no way impact normal operations from NSLRWCD.

Overall Plan for Water Control. The development of the operational plan being proposed was dependent on the determination of appropriate and acceptable canal, DWSA, and treatment cells optimum water elevation. A preliminary analysis of daily stage data at Gordy Road Structure (S-71-1) was done. The investigation revealed that water levels upstream of the Gordy Road Structure are typically maintained between 9.5 and 10.5 ft-NGVD.

The following operating guidelines should be used for Pump Station S-382. The guidelines are based on elevations obtained at the headwater stage of the Gordy Road Water Control Structure:

Pump Combination:
Pump #1 – 60 cfs
Pump #2 – 160 cfs
Pump #3 – 160 cfs

S-382 turn on criteria for flows that exceed base flow condition:

1. Pump 1 should be turned on 8 hrs/day between elevation 9.7 and 10.1.

This operation allows for a smoother transition on trying to achieve capturing 50 percent of the water exceeding baseflow runoff of 15 cfs. In addition this attempts to prevent turning pump 1 on and running the pump at 60 cfs per day in one large step. Based on the discharge rating curve, elevation 9.7 would pass approximately 34-35 cfs over the Gordy Road Control Structure. Therefore, if pump 1 is running 8 hours per day, it would be delivering discharges equivalent to 20 cfs/day into the DWSA and the equivalent of 15 cfs per day would continue to be passed over the Gordy Road Control Structure. As explained above in the “General Objective” section, capturing the baseflow is not part of the intention. Thus at a stage of 9.7 the pump would not capture the baseflow equivalent of 15 cfs.

S-382 turn on criteria during runoff event:

1. If water level increases to elevation 10.1, Pump 1 should be turned on.
2. If water level increases to elevation 10.6, Pump 2 should be turned on
3. If water level increases to elevation 10.8, Pump 3 should be turned on.

S-382 turn off criteria:

1. If water levels have receded to elevation 10.7, Pump 3 should be turned off.
2. If water levels have receded to elevation 10.3, Pump 2 should be turned off.
3. If water levels have receded to elevation 9.7, Pump 1 should be turned off.

The elevations for the operating criteria for S-382 were determined by using a discharge rating curve developed for calculating discharges at the Gordy Road Control Structure given stages by using both the theoretical "over the top Flow equation" and field measurements both obtained by SFWMD. The field measurements were used to calibrate the Coefficient of Discharge, C_d shown below. The rating curve is just developed for water that would be discharged over the gates without any gate openings from NSLRWCD. The elevations were determined by developing a practical operating criteria for the operators while attempting to achieve the intentions stated above in the "General Objectives" section. In addition, by operating the pump station using the above criteria, the pumps will be at its full capacity before NSLRWCD operates the Gordy Road water control structure at approximately elevation 11.

Over the top equation:

$$Q = C_d L \sqrt{2 g H_g^{\,3}}$$

The following is the Discharge rating curve:

Headwater	Q
9	0.00
9.1	0.00
9.2	0.00
9.3	0.78
9.4	5.88
9.5	13.50
9.6	22.97

9.7	33.98
9.8	46.35
9.9	59.94
10	76.24
10.1	95.28
10.2	117.94
10.3	144.05
10.4	172.79
10.5	203.83
10.6	236.96
10.7	272.04
10.8	308.94
10.9	347.56
11	387.82

The NSLRWCD office may request water from the DWSA back into the Ten Mile Creek canal for agricultural use. If the canal at S-382 headwater is below 9.0 ft-NGVD, then the discharge culvert at S-382 should be opened to refill the canal until it reaches the optimum level of 9.5 ft-NGVD. This operation is subject to the availability of water. Although not being a project purpose, this action might temporarily help satisfy agricultural demands mainly in the dry season while maintaining the integrity of the project.

The existing operating conditions at Gordy Road (S-71-1) will remain unchanged as agreed with the North St. Lucie River Water Control District (NSLRWCD). If anything, the operation described above will reduce the number of gate changes needed at the Gordy Road Control Structure.

The following operating guidelines should be used for S-383. The guidelines are based on elevations obtained at the headwater stage of the DWSA. Based on the difficulty of accessing S-383, gate or pump operational changes should not be needed more than once a week.

S-383 operating guidelines for the wet season (June – November):

1. If reservoir level increases to 14.0, discharge 6 cfs to the treatment cell.
2. If reservoir level increases to 15.0, discharge 14 cfs to the treatment cell.
3. If reservoir level increases to 16.0, discharge 23 cfs to the treatment cell.
4. If reservoir level increases to 17.0, discharge 33 cfs to the treatment cell.

5. If reservoir level increases to 18.0 or over, discharge 35 cfs to the treatment cell.

S-383 operating guidelines for the dry season (December – May):

1. If reservoir level increases to 14.0, discharge 4 cfs to the treatment cell.
2. If reservoir level increases to 15.0, discharge 9 cfs to the treatment cell.
3. If reservoir level increases to 16.0, discharge 14 cfs to the treatment cell.
4. If reservoir level increases to 17.0, discharge 21 cfs to the treatment cell.
5. If reservoir level increases to 18.0, discharge 28 cfs to the treatment cell.
6. If reservoir level increases to 19.0 or over, discharge 35 cfs to the treatment cell.

The following table is the discharge rating curve for S-383 during the wet season.

WET SEASON	
DWSA Elevation (ft-NGVD)	DWSA Discharge (cfs)
13.0	0
14.0	6
15.0	14
16.0	23
17.0	33
18.0	35
19.0	35
20.0	35
21.0	35
22.0	35
23.0	35
24.0	35
25.0	35
26.0	35
27.0	35
28.0	35
29.0	35

The following table is the discharge rating curve for S-383 during the dry season.

DRY SEASON	
DWSA Elevation	DWSA Discharge

Ft-NGVD	Cfs
13.0	0
14.0	4
15.0	9
16.0	14
17.0	21
18.0	28
19.0	35
20.0	35
21.0	35
22.0	35
23.0	35
24.0	35
25.0	35
26.0	35
27.0	35
28.0	35
29.0	35

S-384 operating guidelines:
Upon availability of water, S-384 should be operated to maintain the equivalent of 6-18 inches of water storage in the treatment cell. The goal is to make water releases for environmental enhancement. The operation of this structure is based on the optimum water storage capacity of 6-18 inches shown by the model developed by SFWMD.

The NSLRWCD will maintain its normal operations during run-off events. The NSLRWCD will begin operating Gordy if the headwater reaches 11.0 ft-NGVD. Therefore, operation at S-382 should be at full capacity when the canal reaches 10.8 ft-NGVD. Under design head the S-382 pumping station capacity is 380 cfs. If the DWSA reaches the maximum storage capacity of 29.00 ft-NGVD, then pumping at S-382 should stop. The spillway surcharge elevation is 31.6 ft-NGVD with a discharge capacity of about 1440 cfs. If the spillway overflows, S-383 and S-384 shall be closed to avoid worsening existing conditions.

Recreation. Ten Mile Creek Basin water management operations do not include operations specifically for the benefit of recreational activities within the project area.

Water Quality. This section was taken from the Environmental Assessment for the “Ten Mile Creek Water Preserve Area Critical Project”. The intent of the Ten Mile Creek DWSA project is to attenuate stormwater flows into the North Fork of the St. Lucie River. These flows, which originate in the Ten Mile Creek basin, are to be

captured and stored in a DWSA and subsequently pumped into a treatment pond before release back into the creek. The resulting hydrodynamic, physical, and biological treatment is expected to ultimately result in the reduction of undesirable freshwater loads being delivered to the SLE.

Fish and Wildlife. This section was taken from the EA for the "Ten Mile Creek Water Preserve Area Critical Project". The fish and wildlife resources in the footprint of the DWSA will change from citrus grove fauna to an open water system. Preyfish species such as centarchids (sunfish) and mosquito fish will quickly colonize the DWSA. As the DWSA levels decrease these fish can act as forage for wading birds, raccoons and other small mammals, and other organisms. The DWSA will also support reptiles and amphibians including salamanders and turtles.

The treatment cell fauna will stay the same with possibly the addition of a number of organisms suited for shallow water conditions (3-4 feet). Since these conditions currently exist in the wetlands of the treatment cell, increased numbers will occur because of a potentially larger amount of this type of habitat.

The downstream benefits to the St. Lucie Estuary (SLE) back to a healthy and sustainable ecosystem. With a decrease in the size and frequency of freshwater pulses, the waters of the estuary should become clearer and more saline. The estuary is expected to then be able to support shoal grass and oysters and other typical elements of the estuarine fauna. In order to fully restore the Indian River Lagoon (IRL), however, the proposed project will have to act as one part of the improvements recommended in the IRL Feasibility Study, in order to fully return the SLE to a healthy ecosystem and ultimately maximize estuarine benefits. Once the SLE is restored, the IRL system in that area should yield secondary benefits to the nearby seagrass.

Water Supply. Water supply will not be affected. Water pumped into the DWSA would be stormwater normally lost to tide. Local groundwater recharge would be expected to increase, possibly offsetting some effects of agricultural withdrawals on adjoining lands.

Pre-storm Canal Drawdown. In anticipation of heavy rainfall in the Ten Mile Creek Basin from tropical storms,

hurricanes, and other extreme rainfall events, water levels will be drawn down as much as practicable in order to allow for the maximum amount of canal and groundwater storage.

Seepage Control. Any seepage lost through the levee around the impoundment will be recaptured with pump operations, if the criteria for pumping has been met.